6S Return Samples: Assessment of Air Quality in the International Space Station (ISS) Based on Solid Sorbent Air Sampler (SSAS) and Formaldehyde Monitoring Kit (FMK) Analyses

The toxicological assessments of SSAS and FMK analytical results are reported. Analytical methods have not changed from earlier reports. Surrogate standard recoveries from the SSAS tubes were 66-76% for 13C-acetone, 85-96% for fluorobenzene, and 73-89% for chlorobenzene. Post-flight flows were far below pre-flight flows and an investigation of the problem revealed that the reduced flow was caused by a leak at the interface of the pump inlet tube and the pump head. This resulted in degradation of pump efficiency. Further investigation showed that the problem occurred before the SSAS was operated on orbit and that use of the post-flight flows yielded consistent and useful results. Recoveries from formaldehyde control badges were 86 to 104%.

The two general criteria used to assess air quality are the total-non-methane-volatile organic hydrocarbons (NMVOCs) and the total T-value (minus the CO_2 and formaldehyde contributions). The T values will not be reported for these data due to the flow anomaly. Control of atmospheric alcohols is important to the water recovery system engineers, hence total alcohols (including acetone) are also shown for each sample. Octafluoropropane (OFP) is not efficiently trapped by the sorbents used in the SSAS. Because formaldehyde is quantified from sorbent badges, its concentration is also listed separately. These five indices of air quality are summarized below:

Sample Location	Date	NMVOCs (mg/m^3)	OFP[b] (mg/m^3)	T Value[a] (units)	Alcohols (mg/m^3)	Formaldehyde (mg/m^3)
Lab SSAS/For.	09/24/03	19	--	--	5	0.035
SM SSAS/For	09/24/03	16	--	--	5	0.024
Lab SSAS/For.	10/08/03	11	--	--	6	0.048
SM SSAS/For.	10/08/03	13	--	--	4	0.034
Lab SSAS	10/22/03	22	--	--	7	ns[c]
Lab SSAS	10/24/03	19	--	--	7	ns
Acceptable Guideline:		<25	85000	<1	<5	0.050

[a] T calculation not done due to flow anomaly.
[b] n/a = not in analysis plan
[c] ns = no sample available

The table and enclosed analytical results on individual pollutants show that the air quality in general was acceptable for crew respiration through the middle of December 2002. No conclusions can be made about the air quality after that date due to our inability to return air samples from the ISS. Total alcohols are not being consistently controlled to the recently lowered guideline of 5 mg/m^3, which was recommended to protect the water recovery system.

Enclosures
1: Analytical Results of Soyuz 6 SSAS Samples
2: T Values of Soyuz 6 SSAS Samples